

United States
Department of
Agriculture

Forest Service

Pacific
Northwest
Region



Forest Pest Management

3065



INTEGRATED PEST MANAGEMENT

AT REGION 6 NURSERIES



Striving for a healthy forest.

INTEGRATED PEST MANAGEMENT

AT REGION 6 NURSERIES

by

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Integrated Pest Management
at Region 6 Nurseries

Integrated pest management (IPM) for forest nurseries is the maintenance of seedling pests at tolerable levels through planned actions employing a variety of techniques, including biological, cultural and chemical. Implicit in IPM is the formal decision-making process that considers pest populations and their impacts on hosts, and weighs the effectiveness of control methods against their impacts on economics, human health, and the environment.

The Record of Decision for the Final Environmental Impact Statement for Nursery Pest Management (FEIS) (Forest Service 1989) requires Forest Service Nurseries in the Pacific Northwest Region (Region 6) to implement IPM.

The purpose of this report is to document the implementation of IPM at the Region 6 nurseries, Bend Pine Nursery, J. Herbert Stone Nursery, Wind River Nursery, and Dorena Tree Improvement Center. Each nursery has developed its own procedure, as described in this report. This information will be helpful to nursery personnel as procedures require modification over time.

Bend Pine Nursery
Deschutes National Forest
Bend, Oregon

This information for Bend Pine Nursery was obtained through interview with Mahlon Hale on December 15, 1992. Each year, the following process provides the basis for IPM at the nursery.

1. Assess needs: Project what needs to be accomplished and for which crops. Identify chemicals authorized for use. Consult field employees for changes needed in operations or procedures.
2. Prepare Pest Management Plans: Including goals and objectives, historical range in pest activity, and treatments. Submit each year to nursery manager for approval. (Exhibit 1. Decision and Rationale for Pest Management).
3. Submit Pesticide Use Proposal: Form FS-2100-2 to Forest Supervisor for approval.
4. Involve the Public: Send notice to mailing list and publish in local paper the time and place for the public meeting. At the meeting, the nursery presents the plan followed by an open discussion with attendees. Documentation of the meeting includes a record of attendees and pertinent questions, as well as any written comments submitted. The mailing list includes adjacent homeowners, contractors, employees, and any others who have expressed interest.

5. Monitor: Collect information including survey data, observations during seedling production, documentation of needs for action, results of assays of soil and water samples.

6. Take Action: Send orders to the field, including the treatment, areas, precautions, irrigation, coordination, and justification. (Exhibit 2. Order to Field Operations).

7. Notify Workers: Send over DG to all nursery employees and post on conspicuous bulletin board the Notice of actual treatment with time and area specified. Require contractors to check bulletin board each day. Place signs in field.

8. Document treatment: Including actual treatment dates, location and quantities of chemical used.

9. Prepare Annual Pesticide Use Report: Summarize actual pesticide usage and report to Regional Office at end of year.

Concurrent with the above process, the nursery maintains documentation in various forms. The Active Files contain information for each major pest and group of pests. In addition to annual pest management plans and other documents described above, each Active File contains background data, FEIS Record of Decision, and Material Safety Data Sheets for pertinent pesticides.

The pesticide storage building contains a Storage and Use Log that documents dates and quantities of chemicals delivered and taken from the facility.

The Nursery Pest Management Communications notebook contains the monitoring requirements from the FEIS, procedures for amending the FEIS, copies of Decision Memoranda and other pertinent correspondence.

The Hydrology File includes the sampling plan for water monitoring and data collected. Although the nursery is directed to monitor both surface and ground water, there is apparently no way to sample groundwater. Four lysimeters were painstakingly installed in Fall 1989, but have yielded water samples only very rarely. The soil is a very well drained sandy loam. Water in the deep well (1/4 mile deep) on the nursery does not reflect groundwater inputs from the nursery.

Exhibit 1.

Bend Pine Nursery
DECISION AND RATIONALE FOR PEST MANAGEMENT

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PEST:

1. MANAGEMENT GOALS AND OBJECTIVES:

2. PEST STATUS:

3. DECISION:

4. RATIONALE

5. DISCUSSION:

6. REMARKS:

Recommended by: _____ Date: _____

Approved by: _____ Date: _____

Check here ☐ if additional information listed on the reverse side.

Cultural Treatment Request

Date _____

Request by: _____

Requested Treatment

Requested Start Work Date: _____

Requested Completion Date: _____

Areas To Be Treated

<u>Blk.</u>	<u>Sec.</u>	<u>Bed</u>	<u>Remarks:</u>
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Areas NOT To Be Treated

<u>Blk.</u>	<u>Sec.</u>	<u>Bed</u>	<u>Remarks:</u>
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Precautions

Irrigation Needs

1.

Special Coordination Needs

Coordinate with CORs and their contractors to avoid conflicts where possible.

Attachments

When completed, return this copy of request to Nita for filing. Show date(s) and time(s) of completion where applicable.

cc: _____

cc: _____

J. Herbert Stone Nursery
Rogue River National Forest
Central Point, Oregon

This information for J. Herbert Stone Nursery was obtained through interview with Steve Feigner and John Scholtes on February 2, 1993.

Monitoring

Monitoring for most insects and diseases occurs throughout the growing season, by observers walking the fields and with the use of appropriate trapping techniques. Cultural practices usually keep pests at tolerable levels. When the level of pest activity exceeds tolerance or pest populations reach a threshold, then the decision is made to employ additional control methods. The Activity Reports for cultural treatments and perimeter maintenance (Exhibits 3, 4, 5, and 6) include the prescription and IPM decisions, dates of activity, and rates of application. These reports track the implementation of control methods throughout the year, and are filed together by year.

In addition to the Cultural Activity Reports, the nursery keeps records containing information on IPM as follows:

Pests

Each nursery pest has a file containing information on its biology, damage thresholds, and methods and techniques for controlling it. A duplicate of the Cultural Activity Report is placed in the pertinent pest file.

Pesticides

Each pesticide has a file containing the product label, mitigating measures, toxicity information, environmental consequences and reference citations.

At the beginning of the fiscal year, the nursery submits Pesticide Use Proposals to the Rogue River National Forest Supervisor's Office (S.O.), where they are kept on file. The nursery submits proposals for all pesticides used historically at J. Herbert Stone. As the nursery determines when and how much of a pesticide will be used, the nursery calls the S.O. and gets approval. At the end of the year, the S.O. summarizes the actual pesticide use and reports to the Regional Office.

Pesticides are kept in a separate chemical storage building. The log book provides a running inventory of storage and use of pesticides. Local fire authorities receive a yearly update of the inventory.

Water Monitoring

The water monitoring plan includes procedures for water sampling and testing, acceptable limits, and maps of lysimeters and other sample locations. The water monitoring file contains the plan and the results of testing for leachable chemicals including nitrogen, metalaxyl, benomyl and chlorothalonil. Water samples are taken from surface runoff after rain, and the subsurface drainage system and lysimeters for groundwater monitoring.

Soil

In the mid 1980's a large scale study tested for residual pesticides in soil and foliage, and for human exposure through patch tests on the skin of workers mixing and applying pesticides. The study showed no residual pesticides in the soil or foliage, and minimal to non-existent human exposure. The nursery is not currently monitoring soils, and is not required to by the FEIS.

Public Involvement

In February, the nursery mails invitations to the neighbors for a public meeting. During the day before the public meeting, the nursery holds an employee meeting to discuss the pesticides and other methods that might be used and any concerns people may have. At the public meeting, the nursery presents what might occur based on historical patterns.

When a pesticide is in use, information on location and restrictions on entering is posted at the entrances to the nursery. Before soil fumigation or herbicide treatment of fence lines, the nursery physically visits the adjacent property owners. Fields are posted and flagged for the information of employees and contractors. Appropriate precautions for all materials that contractors are likely to encounter are specified in the contract.

The nursery responds to the concerns of each neighbor, for example by not treating a fence line or watering a road for dust control. Occasionally the manager writes a letter to the "Friends of the Nursery" mailing list, which includes local environmental groups, neighbors, and anyone who has expressed interest. Sporadic TV news or radio spots highlight some aspect of nursery operations.

Exhibit 3.

1992

CULTURAL ACTIVITY REPORT/TREATMENT RECORD

ACTIVITY: APPLICATION OF BENLATE

PLANNED STARTING DATE: 5/12/92

AREA TO BE TREATED = 1.75 AC.

CULTURAL GROUP	LOCATION	PRIORITY	RATE	DATE COMPLETED
O 1-0 S. PINE	E-48C TO E-50B	1	1#/100 GAL /ACRE *	
P 1-0 W. W. PINE	E-47A TO E-48C	1	* 1# ACTIVE INGREDIENT	

OBJECTIVE: REDUCE THE IMPACT OF FUSARIUM ON SUGAR PINE AND WESTERN WHITE PINE.

ACTIVITY PRESCRIPTION: MIX 1 POUND (AI) OF BENLATE WITH 100 GALLONS OF WATER AND APPLY TO 1 ACRE ACCORDING TO LABEL INSTRUCTIONS. APPLICATION WILL BE MADE ON A 10-14 DAY INTERVAL FOR THREE TREATMENTS. NOTE ACTIVITY ON EMPLOYEE BULLETIN BOARD AND NOTIFY THE RECEPTIONIST. (48 HR. RE-ENTRY)

IPM DECISION: THE NURSERY INTEGRATED PEST MANAGMENT PLAN FOR THE PREVENTION OF DAMAGE TO SUGAR PINE AND WESTERN WHITE PINE CAUSED BY FUSARIUM INCORPORATES THE FOLLOWING; SEEDBED FUMIGATION, CHLORINATION OF IRRIGATION WATER, SEEDBED MULCHING, LOW PLANTING DENSITY, IRRIGATION AND THE APPLICATION OF BENLATE. WE ARE APPLYING BENLATE AS A PREVENTIVE MEASURE BEGINING WITH 50%E SEEDLING EMERGENCE.

TOTAL AMOUNT APPLIED: _____ CONC. _____ VOLUME _____

CHEMICAL TRADE NAME _____ EQUIPMENT USED _____

SUPPLIER _____ OPERATOR/APPLICATOR _____

IRRIGATION _____ TEMPERATURE _____

WIND _____ WEATHER _____

COMMENTS: _____

1992

Exhibit 4.

CULTURAL ACTIVITY REPORT/TREATMENT RECORD

page 1 of 2

ACTIVITY: BUG VAC FOR LYGUS CONTROL

PLANNED STARTING DATE: 9/8, 9/14 AND 9/21

AREA TO BE TREATED = 56 AC.

CULTURAL GROUP	LOCATION	PRIORITY	RATE	DATE COMPLETED
A 1-0 SHIP PINE	E-32B TO E-50	2		
B 1-0 SHIP D.FIR	E-29B TO E-32B	2		
C 1-0 SHIP LARCH	E-7A TO E-20F	2		
A 1-0 SHIP PINE M 2-0 L.P.P.	E-6C TO E-6F	2		
D-E 2-0 DF SHORT	E-2D TO E-6B	2		
F/G 2-0 DF MEDIUM	B-21B TO B-33B	1		
I 2-0 PP	B-5A TO B-6D	1		
J 2-0 PP/JP MED	B-7A TO B-21B	1		
K 2-0 TF MEDIUM	E-47A TO E-47B	2		
L 2-0 TF TALL	E-47B TO E-47C	2		
M 2-0 LPP SHORT	E-6C TO E-6D	2		
N 2-0 LPP MEDIUM	B-33C TO B-35F	1		
O 2-0 SP	E-48C TO E-50B	2		
P 2-0 WWP	E-47F TO E-48C	2		
Q 2-0 HEM/WRC	E-47A	2		
S SCHED 1-1 TP MED D F, TF, LARCH	E-26C TO E-28F	2		
T SCHED 1-1 TP LG D F, TF,	E-28F TO E-32A E-50C	2		
U 2-0 E S SPRUCE	E-46C TO E-47A	2		
V 2-0 GRAND FIR	E-47C TO E-47E	2		
W 2-0 IC	E-1A TO E-2B	2		
Y SCHED 1-1 TP MED LP, P, PINE	E-32B TO E-33A	2		

OBJECTIVE: REMOVE LYGUS FROM SEEDLINGS.

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J. Herbert Stone

ACTIVITY PRESCRIPTION: RUN VAC OVER SEED BEDS AT APPROPRIATE HEIGHT AND GROUND SPEED TO REMOVE INSECTS WITHOUT DAMAGING SEEDLINGS OR MOVING MULCH FROM SEEDBEDS. DOCUMENT OBSERVATIONS SUCH AS INSECT ACTIVITY, TEMPERATURE, WINDSPEED, WIND DIRECTION, DURATION OF TREATMENT ETC. -ANYTHING THAT COULD BE PERTINENT TO VAC OPERATION.

COMMENTS: BEGIN AT THE NORTH END OF FIELD B AND PROCEED THROUGH FIELD E. REPEAT OPERATION ON A WEEKLY BASIS THROUGH THE WEEK OF 9/21. WE WILL TAKE SOME SAMPLES ON THE WEEK OF THE 28TH TO SEE WHAT LEVELS OF LYGUS ARE PRESENT.

TOTAL AMOUNT APPLIED: _____ CONC. _____ VOLUME _____

CHEMICAL TRADE NAME _____ EQUIPMENT USED _____

SUPPLIER _____ NMIS CODE _____ OPERATOR/APPLICATOR _____

IRRIGATION _____ TEMPERATURE _____

WIND _____ WEATHER _____

COMMENTS: _____

1992

Exhibit 5

CULTURAL ACTIVITY REPORT/TREATMENT RECORD

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ACTIVITY: APPLY NITROGEN (AMMONIUM NITRATE)

PLANNED STARTING DATE: MARCH 11, 1992

AREA TO BE TREATED = 37 AC. (1 TON)

CULTURAL GROUP	LOCATION	PRIORITY	RATE	DATE COMPLETED
I 2-0 PP	D-14E TO D-17B D-25E TO D-28A	1	50	
J 2-0 PP/JP MED	D-4E TO D-14B	1	50	
K 2-0 TF MEDIUM	K-38D TO K-39F	2	50	
L 2-0 TF TALL	K-35D TO K-38D	2	50	
M 2-0 LP SHORT	K-40D TO K-42E	2	50	
N 2-0 LP MEDIUM	D-28E TO D-29E	1	50	
O 2-0 SP	I-14A TO I-14F	3	50	
P 2-0 WWP	I-13F TO I-14A	3	50	
U 2-0 E S SPRUCE	D-32E	1	50	
V 2-0 GRAND FIR	D-32A TO D-32D	1	50	
W 2-0 IC	D-30D TO D-31D	1	50	
TRUE FIR STUDY	K-37, K-38	1	50	

OBJECTIVE: Apply nitrogen for the support of early growth in the above species.

ACTIVITY PRESCRIPTION: Calibrate spreaders. Record sprocket combinations used for future reference. Collect amounts from an 800' run at the beginning and end of this application and document on this sheet. Using this information we can track amounts applied to individual beds. Fertilized units will be watered for a minimum of 30-45 minutes to wash off the foliage and into the soil.

COMMENTS: Take all measures to avoid seedling damage.

TOTAL AMOUNT APPLIED: _____ CONC. _____ VOLUME _____

CHEMICAL TRADE NAME _____ EQUIPMENT USED _____

SUPPLIER _____ NMIS CODE _____ OPERATOR/APPLICATOR _____

Activity Report continued

J. Herbert Stone
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IRRIGATION

TEMPERATURE

WIND

WEATHER

COMMENTS:

1992
CULTURAL ACTIVITY REPORT/TREATMENT RECORD

J. Herbert Stone
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ACTIVITY: FERTILIZER APPLICATION (AMMONIUM NITRATE)

PLANNED STARTING DATE: 3/11/92

AREA TO BE TREATED = 37 AC. (1 TON)

LOCATION	CULTURAL GROUP	PRIORITY	RATE	DATE COMPLETED
D-4E TO D-14B	J	1	50	
D-14E TO D-17B D-25E TO D-28A	I	1	50	
D-28E TO D-32E	I, N, U, V, W	1	50	
K-35D TO K-42E	K, L, M	2	50	
I-13F TO I-14A	O, P	3	50	

Exhibit 6.

J. Herbert Stone Nursery

1992

ROAD, FENCELINE, AND SEEDBED PERIMETER MAINTENANCE ACTIVITY RECORD

ACTIVITY: DICAMBA (BANVEL®) APPLICATION

PLANNED STARTING DATE: AUGUST 19, 1992

Actual

24

AREA TO BE TREATED: SEE ATTACHED MAP AND SPRAY AREA DESCRIPTION
APPROXIMATELY 1 ACRE

LOCATION DESCRIPTION	PRIORITY	RATE	DATE COMPLETED
SERVICE ENTRANCE		1.5 PTS/100 GAL H ₂ O	<i>9-24-92</i>
MEADOW		PER ACRE	<i>9-25-92</i>
WEST SIDE OF COOLERS (GRAVEL AREA)		0.9 #AI/AC	<i>9-25-92</i>

OBJECTIVE: APPLY DICAMBA TO DESIGNATED AREAS TO CONTROL MORNING GLORY AND PUNCTUREVINE POPULATIONS TO PREVENT INCURSION INTO SEEDBEDS.

ACTIVITY PRESCRIPTION: APPLY HERBICIDE AT RATE NOTED ABOVE. DO NOT APPLY IN WIND OR IF RAIN IS IMMINENT (WITHIN 6 HOURS). POST NURSERY GATES WITH WARNING FOR 48 HOURS. NOTIFY OFFICE AND POST ON EMPLOYEE BULLETIN BOARD. NOTIFY AFFECTED NEIGHBORS 24 HOURS BEFORE SPRAYING ADJACENT AREAS.

IPM DECISION: THE NURSERY INTEGRATED PEST MANAGEMENT PLAN FOR THE TREATMENT OF VEGETATIVELY PROPAGATED WEEDS: BURNING OF WEEDS OR APPLICATION OF A POST-EMERGENT HERBICIDE. THERE IS NO TOLERANCE FOR EITHER PUNCTUREVINE OR MORNING GLORY. COOL WEATHER HAS PROMPTED THE EMERGENCE OF NEW PUNCTUREVINE PLANTS. THE DECISION IS TO APPLY DICAMBA (BANVEL®) AT A RATE OF 1 1/2 PTS/ACRE.

COMMENTS: USE BOOM SPRAYER WHERE THERE IS A LARGE CONCENTRATION OF EITHER MORNING GLORY OR PUNCTUREVINE. USE SPRAY WAND ON AREAS WHERE WEED CONCENTRATION IS LOW (IE. 2 SQ FT WEED SURFACE AREA IN A TOTAL OF 40 SQ FT)

TOTAL AMOUNT APPLIED: *4.500* CONC. *1.5* VOLUME *450*

CHEMICAL TRADE NAME *BANVEL* EQUIPMENT USED *boom sprayer*

SUPPLIER NMIS CODE OPERATOR/APPLICATOR *John Doe*

IRRIGATION TEMPERATURE

WIND WEATHER

SAFETY EQUIPMENT USED:

COMMENTS:

Wind River Nursery
Gifford Pinchot National Forest
Carson, Washington

The information for Wind River Nursery is from interview with Ed Olson on February 17, 1993.

Pests

The nursery maintains a file or master plan for each pest, with information on historical damage and management alternatives. The management of many pests does not change appreciably from year to year, except for ones that build up resistance. The Evaluation of Treatment Alternatives and the Decision and Rationale for pest management were both completed in 1990 (Exhibits 7 and 8).

Monitoring

Field workers observe the growing seedlings, looking especially for problems in the 2-0 crops with larch needle cast, Phytophthora root rot, and gray mold. Unusual or intense problems evoke a written response--the Pest Monitoring Data Sheet (Exhibit 9).

Pesticides

Based on historical information and the FEIS, Pesticide Use Proposals were submitted and approved indefinitely in 1989. At the end of each year, the nursery summarizes and reports the actual usage. The field operator prepares an accomplishment sheet with the date, locations, and amounts of chemical used. The daily log kept in the Pesticide Storage Facility is a cross reference for this information. The computer technician enters this information into the data base, which supplies the information for the nursery's Annual Report.

Public Involvement

Every spring, the nursery invites the public to a meeting held during the day and in the evening. The local newspaper, Skamania County Pioneer, publishes an article about the meeting in their Events Column. The nursery also posts a notice about the meeting in the Post Office. In the past, the nursery sent letters to downstream neighbors, and plans to resume this in the near future.

At the meeting, the nursery provides a short presentation and discussion period about nursery practices and policies. For the last 2 years, no one has come to the meeting.

One local resident is concerned about the well water, and the nursery is monitoring nutrients in the well.

Water Monitoring

Four ten-foot deep lysimeters provide a means of monitoring the groundwater. For a few years, the nursery took 4 samples per year from each lysimeter, and sent the samples to 2 different laboratories. Based on the results of this

more intensive sampling, the nursery now samples from the two most sensitive lysimeter locations in the Spring and the Fall. One private laboratory tests the samples for nitrates and the pesticides used at the nursery.

The Wind River Ranger District has a cooperative agreement with the nursery for the sampling of surface runoff, and each year the Ranger District proposes the sampling scheme and budget. The District hydrologist has established sampling points above and below the nursery, and originally scheduled sampling for the Spring, in the summer after significant precipitation, and in the Fall. Based on previous results, the most sensitive sampling time is in the summer following significant precipitation. The nursery informs the District whenever pesticides are applied. The District sends water samples to a laboratory, and sends a report to the nursery if something is detected. The Ranger District has been keeping these records since 1987.

Exhibit 7.

LIST OF MANAGEMENT ALTERNATIVES

Wind River Nursery
page 1 of 2

PEST: Meria Laricis

ALTERNATIVES:

Biological:

NONE AVAILABLE

Cultural:

SOW AT lower density. Encourage 1-0 production over 2-0 or 1-1's.

Chemical:

2-0's SPRAY Benomyl + chlorothalonil AT 2 week intervals STARTING EARLY IN THE SPRING OF THE 2-0 year.

1-0's Depending ON size, condition AND climate, possibly spray IN THE FALL. IN The greenhouses spray IF Meria is observed

No Action:

Do NOTHING.

Treatment Option	Effectiveness(1)	Health Risk(2)	Envir Risk(3)	Cost(4)
No Treatment	Poor	NONE	NONE	cost of cull trees.
Low density, 1-3	very good	none to negligible	none to Negl.	more acres but only for one season seedlings cost less.
Low density, 2-5 1-5 Frequent Fungicide apps.	moderate	negligible	low/moderate	

(1) Use observations, experimental data, gut feelings, etc. to determine this.

(2) Use information from the EIS.

(3) Use information from the EIS.

(4) Use WRN information: e.g.: cost/gal. fungicide; # applications/yr;
cost/hr to apply fungicide; cost of managing each additional bed foot/yr;
etc.

PEST: Meria Laricis

DECISION: Sow AT A slightly lower density. ENCOURAGE Forests To request 1-0's rather than 1-1's or 2-0's.

RATIONALE

Meria INFESTATION is most intense on the 2-0's AND in dense seedbeds. In most cases size can be achieved in one season. With 1-0's we can eliminate the need for frequent applications of fungicides, as well as delivering seedlings that still have needles on them.

10/8/92

Suspected Pest: BOTRYTISDate first observed: ~~August~~ / JULY (This observation is 10/8)Species most affected: Noble firSymptoms: Red needles at base of seedlings & branches,
"shepherd's crook" on affected seedlings

Location and extent of the problem:

TCS, Sec 13

Sample data:

Date sent _____

To whom _____

Prognosis _____

Comments/Recommendations:

Situation or extent seems to be improving.

Dorena Tree Improvement Center
Umpqua National Forest
Cottage Grove, Oregon

This report summarizes information gathered from conversation with Lee Riley at Dorena Tree Improvement Center on March 17, 1993. Documentation and detailed record keeping for IPM at Dorena began in December 1991.

Dorena has different cultural groups with different problems and management. The raised beds are used for genetic tests that cannot tolerate growth loss and mortality due to insects and disease. The test frames or boxes are used to grow sugar pine and western white pine for testing for resistance to white pine blister rust. Effects due to other pests confound the results. The blister rust fungus is cultivated in Ribes gardens some miles away. In addition, Dorena has greenhouses for grafting and rooting from selected phenotypes.

Documentation

Each pest problem will have a folder that contains pertinent excerpts from the FEIS, control and mitigation methods, and the biology of the pest. Documents discussing Pest Control Alternatives (Exhibits 10 and 11) include comparisons of effectiveness and risk. Action threshold, prevention, and treatment are included in the Decision and Rationale for Prevention and Control (Exhibit 12).

Each pesticide has a folder that contains excerpts from the FEIS, label information, Material Safety Data Sheets, mitigation measures, human health and environmental effects, and pertinent research.

Documentation is reviewed annually.

Monitoring

The folder for each pest problem contains a Monitoring Plan (Exhibit 13). Field crews are trained in the recognition of pest problems. All field-going personnel observe the condition of the growing stock, and make notes on their observations. Information is transferred to the Pest Monitoring Data Sheet (Exhibit 14), and a decision made on treatment. Treatment is documented on the Cultural Activity Report/Treatment Record (Exhibit 15).

Pesticide Use Proposals

Dorena serves both the USDA Forest Service and the USDI Bureau of Land Management (BLM), and must submit pesticide use proposals to both agencies. Early in the year, Dorena submits proposals that include all possible pesticides and their maximum amounts to the Supervisor of the Umpqua National Forest and the Washington Office of the BLM. Approval from the BLM takes 90 days. Because BLM policy does not allow the use of herbicides, a weed-eater and black cloth are used between the test boxes.

Public Involvement

Every spring, Dorena sends a letter to those on the mailing list describing the plans for the year. Plans are announced every few months at the employee family meetings, and notices posted. Before spraying in the seed orchards, a notice to the public is published in the legal notices section of the local newspaper.

Water Monitoring

The water monitoring plan is in draft stage. The subsurface drainage system, will be tested 30 days after application for benomyl, chlorothalonil, and metalaxyl in the groundwater. Nitrogen will be tested every 30 days to determine the most informative sampling times. There is no collection system for surface runoff because it soaks into the ground.

ROOTSTOCK/TESTING FRAMES AND NON-GREENHOUSE SEEDLING CONTAINERS

PREVENTION

- A. No action. No treatment would be applied to nursery frames or seedlings to prevent the occurrence of Sirococcus tip blight.
- B. Pasteurized/sterilized/composted growing media. Use of only pest-free growing media could reduce sources of inoculum for seedling infection.
- C. Maintenance of clean soil surface. Maintaining a soil surface which is as free of debris and old needles as possible may reduce some sources of inoculum.
- D. Irrigation control. Reducing the time that seedling foliage is wet by both encouraging air circulation and irrigating early in the day should reduce the incidence and extent of Sirococcus infections.
- E. Pre-sow soil fumigation. Dazomet (Basamid) or Methyl bromide + chloropicrin could be used as a fumigant in the growing media prior to sowing to control Sirococcus populations to some degree.
- F. Spraying of Chlorothalonil (Bravo 500). Chlorothalonil could be applied to the seedlings as protection beginning in April on a 10-14 day rotation until warm, dry weather begins.
- G. Combination of Alternatives B-D. These cultural treatments could be applied to reduce the sources of inoculum, thereby reducing the possibility of seedling infection and spread of the fungus.
- H. Combination of Alternatives B-D, F. These preventative and early treatments could be applied to reduce the possibility of seedling infection and spread of the fungus.

TREATMENT

- A. No action. No treatment would be applied to the frames or seedlings to treat the occurrence of Sirococcus tip blight.
- B. Sanitation. Seedlings affected by Sirococcus, as well as all plant debris, could be removed from the beds to decrease the inoculum and the spread of the disease.
- C. Irrigation control. Continued monitoring of irrigation (see prevention) by reducing the time that seedling foliage is wet should reduce the extent of Sirococcus infections. In addition, use of irrigation heads which emit a fine droplet could reduce some spread by avoiding splashing.

D. Spraying of Chlorothalonil (Bravo 500). Chlorothalonil could be sprayed on the affected areas immediately after detection of the disease and repeated on 10-14 day intervals as long as is necessary to maintain disease control.

E. Combination of Alternatives B and C. These cultural treatments could slow the progress for the disease in the seedling beds.

F. Combination of Alternatives B-D. These treatments could slow the spread of the disease as well as provide some measure of control for the inoculum which is present.

COMPARISON OF CONTROL ALTERNATIVES FOR SIROCOCCUS
ROOTSTOCK/TESTING FRAMES AND NON-GREENHOUSE CONTAINERS

DTIC
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TREATMENT OPTION	HUMAN HEALTH RISK	ENVIRON. RISK	EFFECTIVE.	TRT. COST	PREFER. RANK
PREVENTION					
A. No action	None	None	None	None	Low
B. Clean growing media	None	None	Mod.	Mod.	M-H
C. Clean surface	None	None	L-M	Mod.	Mod.
D. Irrigation control	None	None	L-M	Low	Mod.
E. Pre-sow soil fumigation					
Dazomet	Mod.	Mod.	High	Mod.	Low
Methyl bromide + chloropicrin	High	High	High	High	Low
F. Spraying of Chlorothalonil	Mod.	Mod.	High	L-M	L-M
G. Combination of B-D	Negl-L	Negl-L	M-H	Mod.	High
H. Combination of B-E, F	M-H	M-H	High	L-M	Mod.

TREATMENT OPTION	HUMAN HEALTH RISK	ENVIRON. RISK	EFFECTIVE.	TRT. COST	PREFER. RANK
TREATMENT					
A. No action	None	None	None	None	Low
B. Sanitation	Neglig.	None	L-M	Mod.	Mod.
C. Irrigation control	None	None	Mod.	Low	Mod.
D. Spraying of Chlorothalonil	Mod.	Mod.	High	Mod.	M-H
E. Combination of B and C	Neglig.	None	Mod.	Mod.	M-H
F. Combination of B-D	Negl-M	Negl-M	High	Mod.	High

RAISED NURSERY BEDS

PREVENTION

- A. No action. No treatment would be applied to nursery beds or seedlings to prevent the occurrence of Sirococcus tip blight.
- B. Pasteurized/sterilized/composted growing media. Addition of only pest-free growing media following initial box construction could reduce sources of inoculum for seedling infection.
- C. Solar heating. Covering growing media which is to be reused with polyethylene tarps could reduce populations of Sirococcus present in the soils.
- D. Maintenance of clean soil surface. Maintaining a soil surface which is as free of debris and old needles as possible may reduce some sources of inoculum.
- E. Irrigation control. Reducing the time that seedling foliage is wet by both encouraging air circulation and irrigating early in the day should reduce the incidence and extent of Sirococcus infections.
- F. Pre-sow soil fumigation. Dazomet (Basamid) or Methyl bromide + chloropicrin could be used as a fumigant in the growing media prior to sowing to control Sirococcus populations to some degree.
- G. Spraying of Chlorothalonil (Bravo 500). Chlorothalonil could be applied to the seedlings as protection beginning in April on a 10-14 day rotation until warm, dry weather begins.
- H. Combination of Alternatives B-E. These cultural treatments could be applied to reduce the sources of inoculum, thereby reducing the possibility of seedling infection and spread of the fungus.
- I. Combination of Alternatives B-E, G. These preventative and early treatments could be applied to reduce the possibility of seedling infection and spread of the fungus.

TREATMENT

- A. No action. No treatment would be applied to the seedbeds or seedlings to treat the occurrence of Sirococcus tip blight.
- B. Sanitation of seedbeds. All plant debris could be removed from the beds to decrease the inoculum and the spread of the disease.
- C. Irrigation control. Continued monitoring of irrigation (see prevention) by reducing the time that seedling foliage is wet should reduce

the extent of Sirococcus infections. In addition, use of irrigation heads which emit a fine droplet could reduce some spread by avoiding splashing.

D. Spraying of Chlorothalonil (Bravo 500). Chlorothalonil could be sprayed on the affected seedbeds immediately after detection of the disease and repeated on 10-14 day intervals as long as is necessary to maintain disease control.

E. Combination of Alternatives B and C. These cultural treatments could slow the progress for the disease in the seedling beds.

F. Combination of Alternatives B-D. These treatments could slow the spread of the disease as well as provide some measure of control for the inoculum which is present.

COMPARISON OF CONTROL ALTERNATIVES FOR SIROCOCCUS

RAISED NURSERY BEDS

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TREATMENT OPTION	HUMAN HEALTH RISK	ENVIRON. RISK	EFFECTIVE.	TRT. COST	PREFER. RANK
PREVENTION					
A. No action	None	None	None	None	Low
B. Clean growing media	None	None	Mod.	Mod.	M-H
C. Solar heating	None	None	Mod.	Mod.	Mod.
D. Clean surface	None	None	L-M	Mod.	Mod.
E. Irrigation control	None	None	L-M	Low	Mod.
F. Pre-sow soil fumigation					
Dazomet	Mod.	Mod.	High	Mod.	Low
Methyl bromide + chloropicrin	High	High	High	High	Low
G. Spraying of Chlorothalonil	Mod.	Mod.	High	L-M	M-H
H. Combination of B-E	Negl-L	Negl-L	M-H	Mod.	Mod.
I. Combination of B-E, G	M-H	M-H	High	L-M	High

TREATMENT OPTION	HUMAN HEALTH RISK	ENVIRON. RISK	EFFECTIVE.	TRT. COST	PREFER. RANK
TREATMENT					
A. No action	None	None	None	None	Low
B. Sanitation	Neglig.	None	L-M	Mod.	Mod.
C. Irrigation control	None	None	Mod.	Low	Mod.
D. Spraying of Chlorothalonil	Mod.	Mod.	High	Mod.	M-H
E. Combination of B and C	Neglig.	None	Mod.	Mod.	M-H
F. Combination of B-D	Negl-M	Negl-M	High	Mod.	High

Exhibit 12. DECISION AND RATIONALE FOR PREVENTION AND CONTROL
OF SIROCOCCUS IN ROOTSTOCK/TESTING FRAMES AND NON-GREENHOUSE CONTAINERS

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of 2

PREVENTION

DECISION: All growing media to be used will be as clean as possible - i.e. new media will be used in frames and containers. Soil surfaces will be kept as clean as possible. Irrigation regimes will be closely monitored throughout the growing seasons.

RATIONALE: Although the health and environmental risks of the no action alternatives are low, the cost of losses to disease could prove to be high. Therefore, the no action alternative is rejected.

Application of individual alternatives has been shown to have limited effectiveness. Using a sterile or composted media will reduce the sources of inoculum.

Control of irrigation rates is important in maintaining a healthy seedling while avoiding conditions which may promote the incidence of disease. Although not effective at reducing inoculum levels, control of this factor could prove somewhat effective in avoiding losses to inoculum already present.

The soilless media used in the seedling frames and containers is pre-packaged "clean" media. Therefore, the health and environmental risks involved in chemical fumigation would appear to be unnecessary at this time.

Sirococcus has not proven to be a problem in the recent past in the testing frames, grafted stock, or other non-greenhouse containers at Dorena. As the purpose of the testing/rootstock frames is to provide a seedling with healthy foliage for inoculation, minor tip damage is not a major concern. Therefore, use of Chlorothalonil as a preventative treatment is not warranted at this time.

Culturing combinations, although not very effective at reducing Sirococcus inoculum levels or the incidence of the disease, are a sufficient prevention at present. Therefore, combinations which include chemical use are not necessary based on previous experience.

ACTION THRESHOLD

Presence of Sirococcus is determined by a purplish, sunken canker, often with a small drop of resin in the center. The terminal shoots of infected seedlings often curl or bend over as a result of the canker developing on one side of the shoot. Foliage on the killed terminal dies from the base outward and turns straw-brown in color. Initial sightings of isolated pockets of the disease do not constitute a need for immediate treatment. However, when greater than 10 seedlings in a frame or localized area have been effected by the fungus, treatment will be implemented.

TREATMENT

DECISION: As with any fungal disease, prevention is a key element in controlling the fungus. Upon detection of threshold levels of Sirococcus in the frames, infected seedlings and associated plant debris will be removed, and careful monitoring of irrigation rates will be implemented or continued (see prevention). Applications of Chlorothalonil will be initiated every ten to fourteen days. This spraying will continue as long as is necessary to maintain disease control.

RATIONALE: Although the health and environmental risks of the no action alternatives are low, the cost of losses to disease could prove to be high. Therefore, the no action alternative is rejected.

Removal of infected seedlings from frames or containers can be somewhat effective in reducing nutrient sources for the disease. However, the spores would remain in the infected area.

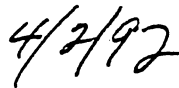
Careful irrigation monitoring and control can be somewhat effective at controlling conditions which are amenable to the spread of disease. However, irrigation control alone does not reduce sources of inoculum.

Using chemical application of Chlorothalonil has proven to be the most effective method in terms of both costs and treatment, with low to moderate health and environmental risks.

The combination of irrigation control and sanitation, with the option of chemical treatment, would provide an effective means of controlling Sirococcus infection.



JOSEPH M. LINN
Center Director



DATE

Monitoring for the presence of Sirococcus will occur on a weekly basis beginning in early April (depending on weather and irrigation). Testing frames, raised nursery beds, and greenhouse grown seedlings will be surveyed for evidence of the disease.

Monitors shall look for possible indicators of the disease. The disease kills the current year's leader usually from the tip downward. The terminal shoots of infected seedlings often curl or bend over as a result of the canker developing on one side of the shoot. Black fruiting bodies (pycnidia) develop in the cankered area and on infected needles.

Exhibit 15.

1992

CULTURAL ACTIVITY REPORT/TREATMENT RECORD

DTIC

ACTIVITY: Application of Bravo 500 (Chlorothalonil)

PLANNED STARTING DATE: 4/24/92

AREA TO BE TREATED: 2 Raised Nursery Beds

LOCATION DESCRIPTION	PRIORITY	RATE	DATE COMPLETED
2nd Year Ponderosa Pine Raised Beds	1	1.5 oz/ 5 gal.	4/24/92

OBJECTIVE: Apply Bravo to designated areas to control Sirococcus populations and avoid tip blight on study seedlings

ACTIVITY PRESCRIPTION: Apply fungicide at rate noted above. Do not apply in wind or if rain is imminent. Post treatment area with warning for 48 hours. Notify office and post in employee lunch room.

IPM DECISION: The Nursery Integrated Pest Management Plan for the treatment of Sirococcus includes the following: Removal of plant debris, careful monitoring of irrigation rates, and application of chlorothalonil (Bravo 500). Sirococcus has reached an unacceptable level. The decision is to apply Bravo.

COMMENTS:

TOTAL AMOUNT APPLIED: 3 GALS

CONCENTRATION 1.5 oz / 5 GAL

CHEMICAL TRADE NAME Bravo 500

EQUIPMENT USED BACKPACK SPRAYER

APPLICATOR C. Armstrong

IRRIGATION No

TEMPERATURE 70°F

WIND No

WEATHER PARTLY CLOUDY

SAFETY EQUIPMENT USED:

COMMENTS: